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Association Between Vitamin D Intake and Obesity During Pre- and Early Adolescence

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ACCEPTANCE

This thesis, ASSOCIATION BETWEEN VITAMIN D INTAKE AND OBESITY DURING PRE- AND EARLY ADOLESCENCE, by Lori A Scholle was prepared under the direction of the Master's Thesis Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Master of Science in the Byrdine F. Lewis School of Nursing and Health Professions, Georgia State University. The Master's Thesis Advisory Committee, as representatives of the faculty, certify that this thesis has met all standards of excellence and scholarship as determined by the faculty.

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ABSTRACT

ASSOCIATION BETWEEN VITAMIN D INTAKE AND OBESITY DURING PRE- AND EARLY ADOLESCENCE

by

Lori A Scholle

Background: Prevalence of obesity in US children has increased substantially. The influence of vitamin D intake on body mass index (BMI) is yet to be clearly defined. Results are mixed regarding the relationship of vitamin D deficiency with obesity in children. The objective of this study was to examine the association between vitamin D intake and BMI over a 6 month period in pre-to early adolescent children in Pittsburgh, PA.

Methods: Secondary analysis was done on 256 healthy 6-14 year old (54% male) Caucasian and African American (70%) children from Pittsburgh, PA. Participants completed a food frequency questionnaire (FFQ) and a Sun Exposure Questionnaire (SEQ) and provided anthropometric measures at 2 time points 6 months apart. Vitamin D intake was compared by BMI status (normal = <85th percentile, overweight = 85th to 95th percentile, obese = >95th percentile) as well as by change in BMI over 6 months. Statistical analysis included descriptive statistics, Kruskal-Wallis analysis of variance, Spearman's correlation, Chi Square test, and regression analysis (vitamin D intake, gender, race, baseline BMI, total energy intake, sun exposure and sunscreen use).

Results: Median reported vitamin D intake was 245.85 IU at baseline and 382.51 IU at 6 month follow up. After subdividing children by BMI, at baseline the obese group reported lowest median intake (188 IU) and at 6 month follow up the normal group reported lowest median intake (374 IU) (P=0.03). Overall relation between vitamin D intake and BMI was significant (P=0.033) but weak (r=-0.015). Regression analysis revealed only baseline BMI status (*P*=<0.001) as a predictor of 6 month follow up BMI. No relation was observed between change in BMI and vitamin D intake.

Conclusion: The results of this study do not support a strong relationship between vitamin D intake and change in BMI status over a 6 month time period.

ASSOCIATION BETWEEN VITAMIN D INTAKE AND OBESITY DURING PRE- AND EARLY ADOLESCENCE

by
Lori A Scholle

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ABBREVIATIONS

BMI	Body Mass Index
DRI	Daily Reference Intake
DXA	Dual-energy X-ray Absorptiometry
FFQ	Food Frequency Questionnaire
IU	International Units
LFFQ	Long Food Frequency Questionnaire
NHANES	National Health Examination Survey
SD	Standard Deviation
SEQ	Sun Exposure Questionnaire
SFFQ	Short Food Frequency Questionnaire
SPF	Sun Protection Factor
UPMC	University of Pittsburgh Medical Center
VDR	Vitamin D Receptors

CHAPTER I

ASSOCIATION BETWEEN VITAMIN D INTAKE AND OBESITY DURING PRE- AND EARLY ADOLESCENCE

Introduction

In the last 20 years the number of individuals in the United States that are considered obese has increased substantially. Seventeen percent (12.5 million) of children and adolescents were classified as obese in 2010 (1–3). Obesity poses a health risk to children as they are more likely to have high blood pressure and elevated cholesterol, which can lead to cardiovascular disease, type 2 diabetes, fatty liver disease, and breathing and musculoskeletal problems. (2)

As the problem continues to grow, studies conducted to identify the causes and determine the long term effects of childhood and adolescent obesity are helping to paint a more complete picture of the disease. Some of the causes identified include energy imbalance, lack of physical activity, the environment, and in a small percentage, genetics, hormone imbalance diseases and pharmaceuticals(4). Scientific studies have focused on these causes but some researchers are investigating whether other factors such as vitamin deficiencies could be contributing to this epidemic. Vitamin D is one such factor that is being explored to see if a deficiency might have an effect on obesity.

Positive associations between vitamin D deficiency and the prevalence of obesity have been shown. Recent studies in the adult population suggested that adequate serum vitamin D levels could be connected to increased adipocyte activity and oxidation of fat as well as the potential for improving insulin sensitivity which can lead to weight loss (5–

7). Studies conducted in children showed a connection between vitamin D status and BMI in that individuals with the lowest concentrations of serum vitamin D are often obese (4,8). Individuals more likely to be at risk for deficiency includes those who are overweight or obese, spend a large amount of time indoors, live in northern latitudes, and have diets lacking adequate vitamin D. Studies have already established a relationship between vitamin D in various settings however the strength and causality of those relationships are still being investigated. The purpose of this study was to describe the association between vitamin D intake and body mass index (BMI) over a 6 month period in a population of pre-to-early adolescent children in Pittsburgh, PA.

Hypotheses

Hypothesis 1: Vitamin D intake is negatively related with BMI in pre-adolescent children regardless of sunlight exposure.

Hypothesis 2: Children who are overweight or obese at baseline using BMI percentile criteria and exhibit no change in BMI status at follow-up will report a lower vitamin D intake than children who exhibit a normalization of BMI over time.

Chapter II

Literature Review

Role of Vitamin D

Vitamin D is a fat soluble vitamin that can be obtained through diet in a few natural and fortified food sources, in supplements and through endogenous production with adequate sunlight exposure (9,10). Vitamin D can take the form of vitamin D_2, which occurs naturally in mushrooms exposed to sunlight and irradiated yeast sterol ergosterol. It can also take the form of vitamin D_3, which is made in the skin through sun exposure and present in oily fish. Whether ingested or endogenously produced, vitamin D must be hydroxylated in both the liver and the kidney before it is considered active. Biologically active vitamin D (vitamin D 1,25 $(OH)_2$) then binds with vitamin D Receptors (VDR) present in various tissues throughout the body to carry out many biological functions (11). Emerging evidence from recent studies suggest that VDR in some tissues, including the colon, brain, breast, prostate and macrophages, are able to complete the last hydroxylation step to produce and activate vitamin D locally (9,11).

The primary recognized role of vitamin D is to promote the absorption of calcium in the small intestine and to maintain homeostatic serum calcium and phosphorous levels that support bone mineralization and growth. In children and adolescents this is especially important as it helps to prevent rickets (9,11,12). The presence of VDRs on most body tissues allows biologically active vitamin D to have a role in cellular proliferation, terminal differentiation, inhibition of renin production and angiogenesis,

stimulation of insulin and macrophage cathelicidin production and a role in gene regulation (11). Vitamin D plays other roles whic
h include the improvement of neuromuscular and immune functions and cardiovascular health and is being considered for its possible role in reducing risk for cancer, diabetes and hypertension (11,13).

Current Vitamin D Intake Recommendations

The 2010 Dietary Reference Intakes (DRI) for vitamin D in children ages 1 to 18 years old is 600 IU with an upper limit of 2,500 IU/day. The American Academy of Pediatrics issued their recommendations for 400 IU of vitamin D for children and adolescents in 2008 and have maintained that stance even with the new recommendations issued in 2010 (14) . The method used to ascertain vitamin D status in humans is the measurement of the serum levels of 25-hydroxyvitamin D [25(OH)D], the circulating form of vitamin D (1,25-hydroxyvitamin D) that has a half -life of about 2-3 weeks (11). Measurement of the biologically active form of vitamin D is not an accurate measure as it usually appears to be normal or above in children and adults who are actually deficient (9). In 2010 the Institute of Medicine suggested that both children and adults with serum levels of Vitamin D that are <20ng/ml were deficient, 21-29mg/ml are insufficient and ≥30ng/mL are sufficient which is also confirmed by the 2011 Endocrine Society Clinical Practice Guidelines (9,11).

Vitamin D Status in Children

In 2012 the Centers for Disease Control and Health Promotion reported that between the years of 2003 and 2006 there were approximately 442,000 children between the ages of 6 and 11 and 2,823,000 adolescents between 12 and 19 that had serum levels of vitamin D that was less than 30 nmol/L and were therefore considered deficient (15). Data collected for the National Health and Nutrition Examination Survey (NHANES) between the years of 2001-2006 on vitamin D status indicated that deficiency occurred in 5-10% of females between 9 and 18 years old and in 2-7% of males of the same age group. The same data indicated that 22-24% of females between 9 and 18 years old and 19-22% of males of the same age group were considered insufficient (16) . The data from these surveys suggest that insufficient vitamin D status in the pediatric population is especially prevalent in the pre to early adolescent stages and puts them at risk for deficiency during key growth periods.

Sources of vitamin D for children and adolescents include sunlight exposure, fortified food sources, such as dairy products and juices, and taking a daily supplement. Bailey and colleagues(17) estimated vitamin D intakes in 9-13 year olds using NHANES 2005-2006 data and found that 53% of males and 47% of females met the adequate intake (AI) levels through diet alone. The same study showed that when a dietary supplement containing vitamin D was added that 66% of males and 53% of females met the AI for vitamin D(17). Fortified dairy product consumption is key to achieving AI of vitamin D levels. A study by Fulgoni and associates(18) demonstrated that African –American males and females ages 2-18 years old had significantly lower dairy intake than their non-African American counterparts. This population is already at risk for vitamin D deficiency due to their dark skin color. These findings reveal the need for education on the importance of consuming vitamin D fortified foods as well as supplements to ensure optimal vitamin D status.

Risk Factors for Vitamin D Insufficiency

There are many risk factors that contribute to an individual's risk for vitamin D deficiency. The most important risk factor is the lack of adequate exposure to sunlight for endogenous production of vitamin D. The amount of sun exposure is affected by many factors including a person's skin color, sunscreen use, geographical location and the season of the year. African Americans and Hispanics produce less endogenous vitamin D due the presence of higher amounts of melanin in their skin which requires them to have 3-5 times the amount of sun exposure to produce similar amounts as compared to Caucasians (9,19). Individuals who use sunscreen to prevent sunburn also block the penetration of UV rays. If the sunscreen SPF is 30 or higher, it can actually reduce vitamin D synthesis in the skin by as much as 95% (11). The amount of time for sun exposure is limited for individuals who live in more northern latitudes due to reduced sunlight availability, weather conditions and day length (20). All of these factors are compounded by the season of the year as winter and fall have shorter days and cooler temperatures and are more likely to have cloud cover and less opportunity for sunlight exposure.

Other factors contributing to deficiency include a diet that is low in natural or fortified vitamin D sources, such as milk, cheeses, yogurts, and the presence of certain health conditions like fat malabsorptive disorders, nephrotic syndrome, primary hyperparathyroidism, chronic granuloma forming disorders and lymphomas. (11)

Relationship between Obesity and Vitamin D

Obesity is another health condition that has been identified as a risk for vitamin D deficiency. Published reports suggest that there is a link between vitamin D status and obesity in child and adult populations. In 2012 Ganji and colleagues(21) explored the overall prevalence of vitamin D deficiency in individuals between ages 12 to 70+ years old in assay-adjusted NHANES data from 1988-2006. Their findings indicated an overall population trend of decreased mean serum vitamin D concentrations by 9% (60.7nmol/L in 1988-1994 to 55.2nmol/L in 2001-2006 – P=<0.001). Specifically in the adolescent population (12-19y/o) there was an overall mean serum vitamin D concentration decrease from 64nmol/L in 1988-1994 to 55nmol/L in 2001-2006 (P=<0.001).(21) The overall number of individuals that experienced vitamin D deficiency (<25nmol/L) increased from 2.4% in 1988-1994 and to 4.7% in 2001-2006. When analyzed in separate categories the adolescent group showed a dramatic the increase from 1.12% to 3.31% (196% - P=<0.001)(21). Ganji et al(21) further explored factors that could influence this decrease in vitamin D levels and found that there was also an overall increase in mean BMI for all the population subsets studied (P=<0.001). They hypothesize that the increase in overweight and obese populations in this data set has had an influence over the lowering of vitamin D status in that these individuals are less likely to engage in outdoor activities thereby limiting sun exposure and are more likely to sequester vitamin D into their adipose tissue. While this very recent study conducted by Ganji and colleagues (21) takes a comprehensive look at the entire US population, which included some adolescents, review of the literature reveals past studies specifically aimed at the pediatric population that also indicate a significant inverse relationship between BMI and vitamin D status.

In a 2010 study, Dong et al(20) examined the prevalence of vitamin D insufficiency/deficiency and potential influences in a cross sectional study of 559 subjects between the ages of 14-18 years old. Anthropometric data were recorded for all subjects. Dual-energy x-ray absorptiometry (DXA) was used to assess lean mass, fat mass and proportion of body fat and serum vitamin D concentrations were used to assess status. Descriptive statistics indicate that the subjects had an average BMI percentile of 61.6% +/-27.8% which indicates that individuals of all BMI categories (underweight – obese) were represented in this study. The overall rate of vitamin D insufficiency was 56.4% and deficiency was 28.8% in this population. The most significant finding this study revealed was significant inverse relationships between vitamin D status and BMI percentile (P= 0.02) waist circumference (P=<0.01), total fat mass (P = <0.01) and proportion of body fat (P=0.01) (20). The consistency of the strength of the inverse relationship between all adiposity measures and vitamin D status in all subjects across the BMI spectrum further confirms that the tendency towards vitamin D insufficiency in overweight and obese subjects strong.

Further review of the literature with the specific aim of exploring this relationship in an exclusively obese population revealed a study conducted by Alemzadeh et al (22) on 127 obese (>95^{th} BMI percentile for age) subjects between the ages 6 to 18 years old in Wisconsin in 2008. In their study vitamin D insufficiency was found in 74% of the total group. More specifically, the group with vitamin D insufficiency/deficiency had higher BMI (41.1kg/m^{2} - P=<0.02) and higher fat mass (54 kg - P=<0.001) than the vitamin D sufficient group (BMI – 33.9kg/m^{2} and 40.8kg) (22). These findings further confirm the inverse relationship between vitamin D status and BMI and the high prevalence of vitamin D insufficiency/deficiency in a population of obese children and adolescents with increasing strength as BMI status becomes higher.

Sequestration in Body Fat Stores

The prevalence of low serum vitamin D in obese adolescents can be attributed to sequestration of vitamin D in fat stores, whether visceral or subcutaneous, which limits it's bioavailability (23–25). Rodriguez-Rodriguez et al(24) conducted a prospective study during the winter months in Spanish children in an attempt to find associations of vitamin D status with anthropometric measurements. Some of the key findings include that subjects with body weight (P=0.002), BMI (P=0.037), waist measurement (P=0.025) and weight height ratios (P=0.025) that were above the 50th percentile were at greater risk for having lower levels of vitamin D (24). Later Rajakumar et al (25) explored the differences in adiposity in Caucasian versus African-American adolescents (n=237) and their relationship with vitamin D status by comparing anthropometric data and biochemical measurements. Overall findings showed that individuals with higher BMIs, percentage of body fat and abdominal adiposity had an inverse relationship with plasma vitamin D levels. African Americans were more likely to have lower overall serum vitamin D levels (P<0.001) and Caucasians with higher levels of visceral fat were more likely to experience vitamin D insufficiency/deficiency (25). Both of these studies demonstrate that the amount and location of body fat, which could potentially sequester vitamin D, could be determining factors in the vitamin D status of children.

Vitamin D Deficiency and Weight Gain

The literature suggests that there is a possible link between vitamin D insufficiency/deficiency and the likelihood to gain weight leading to obesity. Moderate to severe vitamin D deficiency has been shown to cause higher circulating levels of parathyroid hormone which has an influence on the intracellular concentrations of calcium in adipocytes thereby increasing lipogenesis (23,26). The mechanism through which vitamin D plays a role in this process is established when calcium levels in the body are low and the body responds by using serum vitamin D to stimulate the release of more parathyroid hormone which enables the release of more calcium into the blood. Inadequate levels of vitamin D reduce the amount of parathyroid hormone release which in turn decreases serum levels of calcium which increases lipogenesis and reduces lipolysis (23). Because vitamin D and calcium are acquired through diet in similar foods it is logical to assume that individuals who consume limited amounts of these foods are likely to experience deficiencies in both.

One study conducted by Gilbert-Diamond et al(26) in Bogota, Columbia prospectively explored the relationship of vitamin D status and linear growth on a group of children (n=479, aged 5-12y/o) over a 2 year period. They found that children who were vitamin D insufficient/deficient had an increase of 0.1 BMI percentile points (P=0.05) per year, a mean increase of 0.03 subscapular-to-triceps measures (P=0.003), and an increase of 0.8cm/year in waist circumference (P=0.03) as compared to children who were vitamin D sufficient. (22) These findings demonstrate a progressive trend towards increases in adiposity in children who are vitamin D insufficient/deficient and further emphasize the inverse relationship of vitamin D status and increases in adiposity (22). These findings suggest that perhaps maintaining adequate vitamin D status could be a key to slowing or reversing incremental weight gain. Further studies on the influence of both calcium and vitamin D levels in the pediatric population to assess their influence on increases in adiposity should be conducted to better define the relationship.

Nutrition Assessment in Children

Several methods are used to assess nutrient intake in children. Accurate assessment of nutrient intake is challenging to achieve but necessary for usable outcomes in studies. Traditional formats used in nutrient assessment include Food Frequency Questionnaires (FFQ), which can be either long or short in length and can be self-administered or conducted by a professional, 24 hour food recalls, 3 day dietary recalls, observed food intake and weighted food inventories of varying lengths (27,28). Observed food intakes and weighted food inventories, while accurate, can be time consuming, expensive and difficult to administer due to the requirements of trained staff and the need for equipment to administer in a large study population. Some methods, such as the 24 hour recall and the 3 day food record are better suited for use in a large study population because they are relatively quick and inexpensive to administer. The 24 hour recall is useful for providing information for the previous day but often exaggerates estimates of nutrients, whereas a 3 day food record provides a better picture of habitual dietary intake (27,29,30). For more specific nutrient information the use of a FFQ designed to ask pointed questions specific to the nutrient and age group in a study can also be an effective and inexpensive method to gather data. In 1995 Rockett and her colleagues tested the reproducibility and validity of data obtained in specially designed short FFQs (SFFQ) compared to an established long FFQ (LFFQ). The study produced an abbreviated version of the LFFQ and included specific questions that considered not only foods containing the nutrient but the format in which being consumed, i.e. snacks. Results indicated that the estimates from the LFFQ and SFFQ were similar and that

SFFQ were a reliable format to use when obtaining dietary nutrient intake data in a healthy adolescent population (29).

Chapter III

Methods and Procedures

Participants

Study population is comprised of 296 healthy, pre-to-early adolescent, (6-14) years old) African American and Caucasian children residing in Pittsburgh, PA. Subjects were recruited from the Primary Care Center of the Children's Hospital of Pittsburgh of the University of Pittsburgh Medical Center (UPMC). Individuals excluded were those being treated with anticonvulsants or systemic glucocorticoids or those having hepatic or renal disease, malabsorptive disorders, cancer, disorders of vitamin D or calcium metabolism, taking oral contraceptives or depot medoroxyprogesterone.

The study was conducted as part of Dr. Rajkumar's National Institutes of Health-funded (R03-K23 grants) vitamin D clinical research protocols whose objectives were to assess the seasonal variation and racial differences in African American and Caucasian children and refine the serum 25(OH)D thresholds for defining vitamin D insufficiency in children. The study occurred in two phases: Phase I monitored the subjects for sunlight exposure and vitamin D intake and was conducted in 2006-2008. Phase II randomly assigned a vitamin D supplement (1000 IU D_3) or placebo to the subjects and was conducted between 2008 and 2011. Subjects enrolled in the randomized control trial were either not taking a multi vitamin or willing to stop taking multivitamins for at least 1 month for a washout period prior to entry to the study. Vitamin D research protocols were approved by the University of Pittsburgh Institutional Review Board and signed parental informed consent and participants' assent were obtained prior to enrollment.

Demographics, Anthropometrics and Sunlight Exposure

At baseline and 6 month follow-up, subjects were measured for age, height and weight. BMI was calculated and classified as obese if age and gender based BMI was >95th percentile. In addition to taking anthropometric measurements, a 21 question Vitamin D and Sunlight Exposure Questionnaire (SEQ) was also administered at each visit. Questions about ethnicity, race, supplements (multivitamin, vitamin D, calcium, cod liver oil, and nutrition supplement drinks) with brand specification and their frequency of consumption, and dairy consumption (includes portion and frequency of milk, chocolate milk, cheese, yogurt), Vitamin D fortified orange juice, fish consumption, and breakfast cereal consumption were included to estimate the amount of vitamin D consumed through diet. Exposure to sunlight was addressed in 4 questions with respect to how much time is spent outside each day, what area of the body is usually exposed to the sun (face, hands, arms, legs), sunscreen application, and opportunities to travel to sunny locations for holidays (Appendix A).

Vitamin D Intake

All subjects were asked to complete a FFQ at baseline and 6 months later. The FFQ, titled Eating Survey, K-95-1, (Harvard Medical School, © 1995 Brigham and Women's Hospital) was analyzed at Brigham and Women's Hospital. After processing and analysis, nutrient intake data comprised 17 nutrients including total calories, dietary calcium and vitamin D (Appendix B). Nutrition data from this FFQ were used for the current study.

Data Analysis

Statistical analysis was performed using SPSS (version 18.0, SPSS, Inc; Chicago, IL). Univariate frequency analysis was performed on the collected data to describe the study population. Non-parametric methods were used as the data were found to be skewed even with log transformation and removal of outliers. All data were expressed as median (25%,75%). Kruskal-Wallis, Spearman's Correlation, and Chi Square methods were used to assess the statistical significance of an association between Vitamin D intake status and BMI status change from baseline and 6 month follow-up. Vitamin D intake was categorized to define status: intake of ≥400 IU was considered sufficient; intake of <400 IU was considered insufficient. Change in BMI status was defined as any change in the baseline BMI percentile category, whether positive or negative. A multiple linear regression analysis was performed to explore the influence of various factors (vitamin D intake, total energy intake, sun exposure, sunscreen use, race and gender) on BMI status change. Additional multiple linear regression analysis were performed using the same factors but participants were subdivided by race and gender. For all tests, $P<0.05$ was considered significant.

Chapter IV

Results

Demographics

A total of 256 healthy, pre –to-early adolescents with a median age of 10 years (range 6 to 14 years old) were enrolled in the study (Table 1). The majority of the participants were African American (70%) and male (54%) (Table 1). Median anthropometric measures of height, weight, and BMI increased from baseline to 6 month follow up (Table 2).

Nutrient Intake

Median vitamin D intake was 245.8 IU at baseline with a slight increase to 382.5 IU at the 6 month follow up, both of which are under the American Academy of Pediatrics 2008 recommendation of 400 IU per day (Table 3) (14). Median vitamin D intake for subjects subdivided by BMI category (Normal, Overweight, and Obese) at baseline revealed a significant difference with the lowest median intake (188 IU) reported by the obese group (P=0.033) (Tables 2 and 3). The vitamin D intake reported at the 6 month follow-up visit by BMI category revealed that the normal weight group consumed the lowest median intake (374 IU); however, this difference was not statistically significant (P=0.435). Vitamin D intake status divided by BMI category at baseline revealed that 73% of subjects consumed <400 IU and only 25% or that populations was obese. Vitamin D intake status divided by BMI category at 6 month follow up revealed that 52% of subjects consumed <400 IU and 50% of those subjects were considered obese. The statistical analysis at both time periods revealed no significant associations. Total population median energy intake was 2260 kcal a day at baseline with a slight increase to 2587 kcal at 6 month follow up.

The FFQ revealed two major food sources for vitamin D in this population: consumption of at least 2 glasses of milk (8oz) and 1 serving of cheese (1oz) per day at baseline and 6 month follow up visit (Table 4). Intake of the other foods listed on the questionnaire such as yogurt, fortified orange juice, and special milk was minimal. Approximately 20% of the total population reported taking a daily multivitamin and <1% reported taking vitamin D or calcium supplements at both baseline and 6 month follow up visits (Table 5).

Sunlight Exposure

The majority of subjects reported sunlight exposure of > 2 hours/day with <50% using sunscreens (Table 6). At baseline only 98 (38%) subjects reported sunscreen use while 94 (44%) subjects reported use at 6 month follow up.

Influence of Vitamin D Intake on BMI Status

Although a relationship between vitamin D intake and BMI at the 6 month follow up for the whole group was observed, the strength of the influence was extremely weak ($R=0.015$, $P=0.033$) (Figure 1). Multi-factorial regression analysis revealed that the only significant predictor of change in the 6 month follow up BMI was the subject's baseline BMI status ($P<0.001$). Gender, race, total energy, vitamin D intake, sunlight exposure and sunscreen use did not influence change in BMI at 6 month follow up. After subdividing the population by race and gender, the only significant predictor variable of change for 6 month follow up BMI was the baseline BMI measure.

Analysis of the influence of adequate vitamin D intake on BMI status change in all subjects showed that the group consumed <400 IU of vitamin D per day, 89.2% maintained their baseline BMI status. In the same category, the subjects who experienced change in BMI status (increase or decrease), only 8.1% showed an increase and 2.7% showed a decrease (Figure 2 and Table 7). In the group who consumed ≥ 400 IU of vitamin D, 85.4% maintained their baseline BMI status, 9.7% increased and 4.9% decreased their BMI (Figure 2). Neither analysis revealed any statistical significance.

Chapter V

Discussion and Conclusion

Vitamin D Intake and BMI in the Total Population

The primary purpose of this study was to investigate an association between vitamin D intake and BMI in African American and Caucasian children. We found a weak but positive relationship between increasing BMI and increasing vitamin D intake. This relationship is contradictory to the trend we expected to see between the variables. The unanticipated weakness and direction of this correlation could be related to a myriad of factors which include the short follow up period of the study which perhaps did not allow enough time for significant change to occur and baseline BMI which is typically a predictor of future BMI. Race and gender are other factors that could have influenced this weakness because each subset has unique characteristics that affect vitamin D status and weight.

Further exploration of the possible effect of some of these factors on our outcome revealed that the only factor with significant influence on changes in follow up BMI was the subject's baseline BMI. This confirms results from previous studies by Whitaker et al (31). They found that an obese BMI classification at 6 years of age made a person 50% more likely to be obese as an adult thereby indicating that current BMI can be a predictor of future BMI status (31). This shows that current BMI can be a predictor of future BMI although it is noted that our study had a short time frame and that significant change in BMI at 6 month follow up would not be likely without some drastic measures such as dieting or extreme caloric intake.

The use of vitamin D intake as the sole predictor of BMI status in this study could have had an effect on our outcomes. Our vitamin D intake data was compiled through the use of a FFQ and a SEQ which included some vitamin D specific food questions and relied on parent or subject recall for accuracy. The validity of data produced in these types of surveys has been proven effective in previous studies but it should be noted that there is room for error in actual food recall and therefore possible inaccurate nutrient totals should be considered. Review of the literature reveals that in studies conducted on the validity and reproducibility of nutrient intake data in FFQs indicated that there is evidence of over and under reporting. Blom et al (32) reported that the frequency of certain food groups like sweet snacks and meats were underestimated while other foods such as fruits and vegetables were often overestimated. These trends suggest that subjects are more likely to report what they felt would be the appropriate amount versus recording their actual intake. In another such study Rockett and colleagues (30) developed and subsequently administered a youth/adolescent questionnaire twice, one year apart, on 179 children (9-18 years of age) to determine reproducibility of data. Their findings differed from Blom et al (32) in that the data provided by the subjects were consistent and did not show any bias towards under or over reporting of particular food groups.

It should also be noted that the baseline overall median vitamin D intake for the whole group in all BMI categories increased by at least 100 IU at the 6 month follow up visit. This could be attributed to the participants who were given the 1000 IU of vitamin

D (n=22) in the randomized group or a more likely explanation is heightened awareness of the importance of vitamin D intake on the individual as a result of filling out the FFQ at baseline which could result in greater consumption of vitamin D rich foods or the over-estimation of intake. Interestingly median reported intakes for all vitamin D fortified foods were almost exactly the same at baseline and 6 month follow up.

One way to overcome this possible inaccuracy is to use serum vitamin D concentrations which could have provided a more accurate assessment of vitamin D status at each visit. Total vitamin D intake is just one factor that would have an influence on vitamin D status which can be affected by other lifestyle factors such as sun-exposure and sunscreen use. A study by Wu and colleagues (33) showed that there was a highly significant relationship between the vitamin D intake on the FFQ and serum vitamin D status provided by the subjects thereby proving that the FFQ could be an effective tool for assessing vitamin D status in winter months. It should be noted that their study population included only Caucasian and Asian populations whereas ours was 70% African American. We did use a validated FFQ that specifically addressed vitamin D intake and in theory could say these vitamin D intake would relate to serum vitamin D levels if they were available. Our study was not confined to one season of the year and the variation of seasons would have an influence on the similarity of our subjects FFQ intake data and serum vitamin D concentrations.

Because our population was comprised of 70% African Americans and was conducted throughout the year, intake alone might not have provided the most accurate assessment of vitamin D status. It should also be noted that the majority of our population reported > 2 hours a day of sun exposure, with <50% reporting sunscreen use.

Statistical analysis did not reveal a significant relationship between BMI and sunlight exposure. This information would have been more useful if we were evaluating serum vitamin D levels and compared FFQ vitamin D intake and sunlight exposure data to see if there was a significant difference.

The only other factor that demonstrated a trend towards effecting BMI change at 6 month follow up was vitamin D intake. Further analysis of the influence of vitamin D sufficiency on BMI change was done by dividing our study population by BMI category (Normal, Overweight, and Obese) and median vitamin D intake (<400 IU insufficient; >400 IU sufficient) and the results were surprising. At baseline the category with the lowest vitamin D intake (188 IU) was the group that was considered obese, which was expected. Interestingly, at 6 month follow up the category with the lowest median vitamin D intake (374 IU) was the group that was considered normal. This outcome was not anticipated and in fact is the opposite of trends that were reported in the literature (20,21,24).

Relationship of BMI Change and Vitamin D Intake

Our analysis of the influence of adequate vitamin D intake on BMI status change in all subjects revealed that among those who consumed adequate intake (≥400 IU) of vitamin D, 85.4% maintained their baseline BMI status. This lack of change in the overwhelming majority of the population is expected as any significant change in BMI status in a 6 month time frame would likely be due to extreme measures such as strict dieting, excess exercise or a growth spurt. Some subjects who consumed adequate amounts of vitamin D did exhibit some BMI change; 9.7% showed an increase in BMI and 4.9% showed a decrease in BMI. These changes were minor and did not show a statistically significant relationship between BMI change and vitamin D intake. For the subjects who consumed <400 IU of vitamin the results are similar in that 89.2% of subjects maintained their BMI status. Only 8.1% demonstrated a BMI increase and 2.7% had a BMI decrease. The percentage of individuals who experienced a reduction in BMI status in the group who had adequate vitamin D intake was higher (4.9%) than in the group who had inadequate intake (2.7%) which was what we expected, however, analysis did not reveal any statistical significance

Conclusion

The results of our study do not support a strong relationship between vitamin D intake assessed through FFQ and BMI change over a 6 month time frame. Perhaps a study of longer duration that utilized serum vitamin D status is needed to observe a more significant relationship between BMI status change and vitamin D intake.

Table 1
Demographics: Characteristics of Study Sample

	N (%)
Age in Years	
6	20 (7.8)
7	17(6.6)
8	42(16.5)
9	46(17.9)
10	38(14.8)
11	42(16.5)
12	20(7.8)
13	16(6.3)
14	15(5.8)
Gender	
Male	139 (54)
Female	117(46)
Race	
Caucasian	77(30)
African American	179(70)

Table 2
Anthropometrics:
Measurements of Study Sample

Characteristic	Baseline	6 Month Follow Up	Change
Height (cm)	139.6 (130.5,150.4)	142 (133.5, 155.2)	+2.4
Weight (kg)	36.8 (30,48.7)	40.2 (31.9, 53.22)	+3.4
BMI (g/kg^{2})	18.9 (16.6, 22.3)	19.5 (16.9, 22.9)	+0.63
BMI <85%	151 (59%)	118(56%)	-33
BMI>85%-95%	45 (18%)	38 (18%)	-7
BMI>95%	60(23%)	56(26%)	-4

All values are expressed as Median (25%, 75%)

Table 3

Vitamin D and Energy Intake at Baseline and 6 Month Follow Up

Divided by BMI Category[1]

	Baseline (n=256)	**6 Month Follow Up (n=214)**
Total Calories (kcal)	2260 (1714.2, 2963.7)	2587 (1845, 4042)
Total Vitamin D Intake (IU)[2]	254.8 (147.8, 407.3)	382.5 (187.6, 810.7)
Vitamin D Intake for BMI<85%	260 (151, 407)	374 (186, 665)
Vitamin D intake for BMI >85-95%	300 (183, 492)	489 (261, 1099)
Vitamin D intake for BMI >95%	188 (119, 335)	378 (174, 1090)

[1] *All values are expressed as Median (25%, 75%)*

[2] *DRI 400IU –Source: American Academy of Pediatrics*

Table 4

Median Daily Vitamin D Fortified Food Intake

	Baseline		Follow up	
Food (serving size)	**N**	**Median Number of Servings (25%, 75%)**	**N**	**Median Number of Servings (25%, 75%)**
Milk (8oz)	252	2 (1, 3)	213	2 (1, 2.5)
Special Milk[1](8oz)	207	0 (0, 1)	171	0 (0, 1)
Cheese (1oz)	239	1 (1, 2)	199	1 (1, 2)
Yogurt (1c)	233	0 (0, 1)	192	0.5 (0, 1)
Fortified Orange Juice (8oz)	207	0 (0, 1)	172	0.1 (0, 1)

[1]*Chocolate milk, soy milk, Lactaid®*

Table 5

Supplement Intake

Supplement Type	Subjects Reporting Consumption at Baseline (n=256)	Subjects Reporting Consumption at 6 Month Follow-up (n=212)
Multivitamin	44	46
Vitamin D	4	8
Calcium	1	8

Table 6

Sun Exposure Reported in Sunlight Exposure Questionnaire (SEQ)

	<2 Hours Per day (%)	**>2 hours Per Day (%)**	**Missing(%)**	**Sunscreen Use (%)**	**No Sunscreen Use (%)**
Number of Subjects Reporting at Baseline (n=256)	41(16%)	209 (81%)	6 (3%)	98 (38%)	157(62%)
Number of Subjects Reporting at 6 Month Follow Up (n=212)	24 (9%)	187 (73%)	45(18%)	94(44%)	118(56%)

Table 7
Vitamin D Intake Status by BMI Status
Baseline and 6 Month Follow Up

Baseline

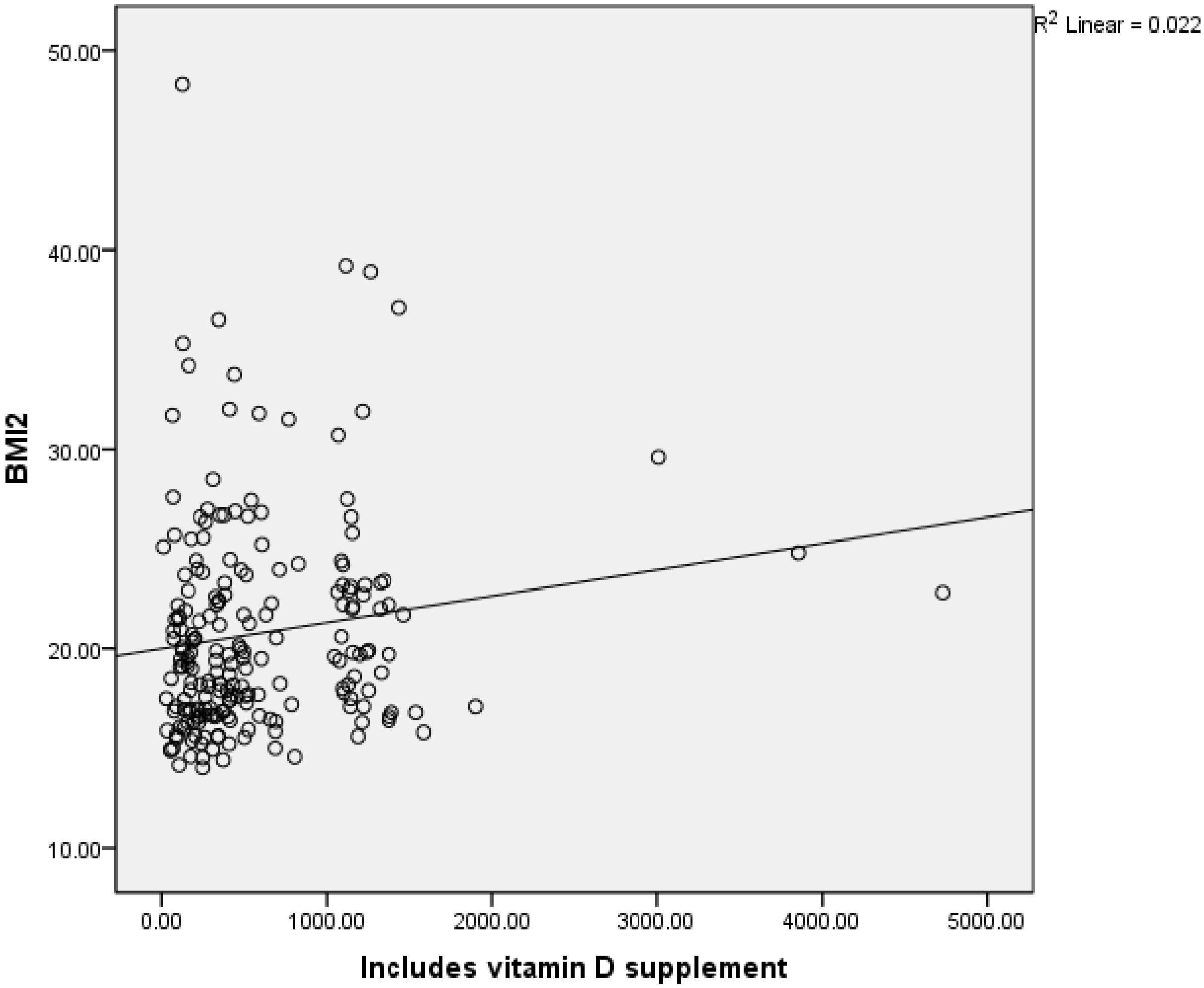
	Normal BMI n (%)	**Overweight n (%)**	**Obese n (%)**	**Total**
≥400 IU Vitamin D	41 (27.2)	15 (33.3)	12 (20)	68 (26.6)
<400 IU Vitamin D	110 (72.8)	30 (66.7)	48 (80)	188 (73.4)
Total	**151**	**45**	**60**	**256**

6 Month Follow up

	Normal BMI n (%)	**Overweight n (%)**	**Obese n (%)**	**Total**
≥400 IU Vitamin D	55 (46.2)	20 (52.6)	28 (49.1)	103 (48.1)
<400 IU Vitamin D	64 (53.8)	18 (47.4)	29 (50.9)	111 (51.9%)
Total	**119**	**38**	**57**	**214**

Figure 1

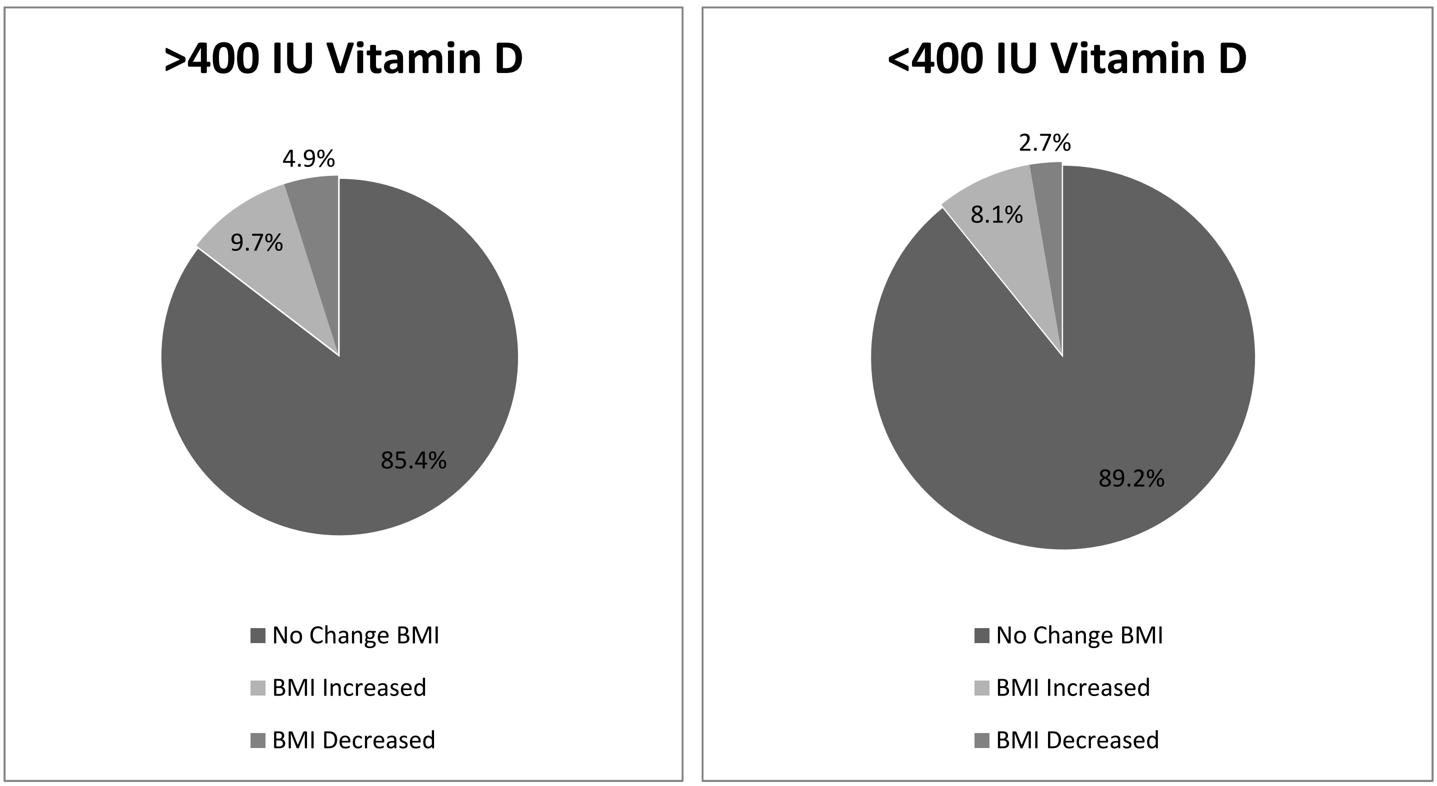
Regression Analysis of Vitamin D Intake and BMI at 6 Month Follow up



R=0.15

Figure 2

BMI Status Change by Vitamin D Intake Category



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APPENDICES

Table 1. Vitamin D & Sunlight Exposure Questionnaire*

Subject ID: __________ **Subject Initials**: __________ **Interview Date:** __________

1. Date of Birth: ___________

2. What is your child's age: ___________

3. Height (cm): ___________

4. Weight (kg): ___________

5. Ethnic Group: Is your child Hispanic or Latino?

❑ Yes ❑ No ❑ Unknown/Declined to answer

6. Race: what do you consider your child's race to be?

❑ American Indian/ Alaskan Native ❑ Asian American

❑ Native Hawaiian/ Pacific Islander ❑ Black or African American

❑ White or Caucasian ❑ More than one race

7. Does your child take a multivitamin? ❑ Yes ❑ No

If yes,
Specific brand (s): ______________________________________
How often does he/she take the Multivitamin? _______________

8. Does your child take a calcium supplement? ❑ Yes ❑ No

If yes,
Specific brand (s): ____
How often does he/she take the Calcium supplement? _______________

9. Does your child take a vitamin D supplement? ❑ Yes ❑ No

If yes,
Specific brand (s): ____
How often does he/she take the Vitamin D supplement? ___________________

10. Does your child take Cod Liver Oil? ❑ Yes ❑ No

If yes,
Specify how much per day: ______________________________
Specific brand (s): ______________________________________

11. On average, how many glasses (8 ounce/glass) of milk does your child drink per day?
____

12. Besides milk, does your child drink/eat other dairy foods that may have been fortified with vitamin D?

If yes,

How many glasses (8ounce/glass) of Soymilk or Lactaid® milk or Chocolate milk does your child drink per day? ________________

How many servings of cheese (1 ounce or 1 slice/serving) does your child eat per day? ___________

How many servings (1 cup/serving) of yogurt does your child eat per day? ____________

13. Does your child drink vitamin D-fortified orange juice?

If yes,

How many glasses (8 ounce/glass) of vitamin D fortified orange juice does your child drink per day? ______

14. On average, how many times per month does your child eat the following foods?

		None (0)	1x/ month	2x/ month	3x/ Month	4x/ month	More than 4 times/month
14a	Baked/fried fish						
14b	Lox (cured salmon)						
14c	Herring						
14d	Salmon						
14e	White fish						
14f	Sardines						
14g	Mackerel						
14h	Dried Mushrooms						

15. Does your child drink a nutrition supplement like Ensure®, PediaSure® or Carnation® Instant Breakfast? ❑ Yes ❑ No

If yes,

How many servings (8 ounces or 1 package/serving) per day: ____________________

Specify brand(s): ____

16. Does your child eat breakfast cereal? ❑ Yes ❑ No

If yes,

How many bowls (1 ½ cups) per week: ___________________

Specify brand(s): ______________________________________

17. Does your child eat breakfast bars or protein bars? ❑ Yes ❑ No
If yes,
How many servings (1 bar/serving) per week: ____________
Specify brand(s): ____________________________________

18. On average in the summer how many hours per day does your child spend outside in the sun each day?
❑ 2 hours or less ❑ More than 2 hours
If more than 2 hours, how many hours: ______________________

19. When your child spends time outside, which of the following body parts are usually exposed?

19a.	Face	……………………………………	❑ Yes	❑ No
19b.	Hands	……………………………………	❑ Yes	❑ No
19c.	Arms	……………………………………	❑ Yes	❑ No
19d.	Legs	……………………………………	❑ Yes	❑ No

20. Do you apply sunscreen on your child when he or she goes outside? ❑ Yes ❑ No
If yes,
20a. What brand (s) do you use? ______________________________________
20b. What SPF (Sun Protection Factor) do you use? _________________________
20c. How often do you use sunscreen on your child?
❑ Often ❑ Sometimes ❑ Seldom

21. Did your child travel to a sunny location for a holiday? ❑ Yes ❑ No
If yes,
21a. Where did your child visit:___________________________________
21b. When last did your child travel: _______ year ________ month ________
21c. How many days did your child spend in the sunny location: ___________

---

*Adapted from Dr. Michael Holick's vitamin D questionnaire

Vitamin D content of foods used in nutrient analysis:

Multivitamin (each, if specific brand not listed)	400 IU
Cod liver oil (tsp)	453 IU
Milk (8 oz)	124 IU
Soy milk (8 oz)	114 IU
Lactaid® milk (8 oz)	100 IU
Chocolate milk (8 oz)	128 IU
Cheese (1 oz)	6 IU
Vitamin D fortified orange juice (8 oz)	100 IU
Baked fish (3 oz)	39 IU

Lox (1 oz)	119 IU
Herring (3 oz)	182 IU
Salmon (3 oz)	233 IU
Whitefish (3 oz)	130 IU
Sardines (3 oz)	164 IU
Mackerel (3 oz)	88 IU
Dried mushrooms (3 oz)	146 IU
Nutrition supplement (8 oz, if brand not listed)	119 IU
Breakfast cereal (1.5 cups, if brand not listed)	60 IU

MARKING INSTRUCTIONS

- Use a **NO. 2 PENCIL** only.
- Do not use ink or ballpoint pen.
- Darken in the circle completely.
- Erase cleanly any marks you wish to change.
- Do not make any stray marks on this form.

The RIGHT way to mark your answer! ●

The WRONG way to mark your answers!

USE NO. 2 PENCIL ONLY

42

A	0	0	0	0	0	0	0
B	1	1	1	1	1	1	1
C	2	2	2	2	2	2	2
D	3	3	3	3	3	3	3
E	4	4	4	4	4	4	4
	5	5	5	5	5	5	5
	6	6	6	6	6	6	6
	7	7	7	7	7	7	7
	8	8	8	8	8	8	8
	9	9	9	9	9	9	9

A

1. What is your AGE?

- ○ Less than 9
- ○ 9
- ○ 10
- ○ 11
- ○ 12
- ○ 13
- ○ 14
- ○ 15
- ○ 16
- ○ 17
- ○ 18 or older

2. Are you:

- ○ Male
- ○ Female

3. Your Height

FEET	INCHES	
0	0	0
1	1	1
2		2
3		3
4		4
5		5
6		6
7		7
		8
		9

4. Your Weight (lbs)

0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
	5	5
	6	6
	7	7
	8	8
	9	9

1 2 3 4

Questionnaire refers to what you ate over the past year.

5. Do you now take vitamins (like Flintstones, One-A-Day, etc.)? 5 5a 5b

○ No ○ Yes → **If yes)**

a) How many vitamin pills do you take a week?

- ○ 2 or less
- ○ 3 - 5
- ○ 6 - 9
- ○ 10 or more

b) For how many years have you been taking them?

- ○ 0 - 1 years
- ○ 2 - 4
- ○ 5 - 9
- ○ 10+ years

6. How many teaspoons of sugar do you ADD to your beverages or food each day? 6

- ○ None/less than 1 teaspoon per day
- ○ 1 - 2 teaspoons per day
- ○ 3 - 4 teaspoons per day
- ○ 5 or more teaspoons per day

7. Which cold breakfast cereal do you usually eat? 7

- ○ Never eat cold breakfast cereal

0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

8. Where do you usually eat breakfast? 8

- ○ At home
- ○ At school
- ○ Don't eat breakfast
- ○ Other

9. How many times each week (including weekdays and weekends) do you usually eat breakfast prepared away from home? 9

- ○ Never or almost never
- ○ 1 - 2 times per week
- ○ 3 - 4 times per week
- ○ 5 or more times per week

123203

43

10. How many times each week (including weekdays and weekends) do you usually eat lunch prepared away from home?

- ◯ Never or almost never
- ◯ 1 - 2 times per week
- ◯ 3 - 4 times per week
- ◯ 5 or more times per week

11. How many times each week do you usually eat after-school snacks or foods prepared away from home?

- ◯ Never or almost never
- ◯ 1 - 2 times per week
- ◯ 3 - 4 times per week
- ◯ 5 or more times per week

12. How many times each week (weekdays and weekends) do you usually eat dinner prepared away from home?

- ◯ Never or almost never
- ◯ 1 - 2 times per week
- ◯ 3 - 4 times per week
- ◯ 5 or more times per week

13. How many times per week do you prepare dinner for yourself (and/or others in your house)?

- ◯ Never or almost never
- ◯ Less than once per week
- ◯ 1 - 2 times per week
- ◯ 3 - 4 times per week
- ◯ 5 or more times per week

14. How often do you have dinner that is ready made, like frozen dinners, Spaghetti-O's, microwave meals, etc.

- ◯ Never/less than once per month
- ◯ 1 - 2 times per week
- ◯ 3 - 4 times per week
- ◯ 5 or more times per week

15. How many times each week (including weekdays and weekends) do you eat late night snacks prepared away from home?

- ◯ Never/less than once per month
- ◯ 1 - 2 times per week
- ◯ 3 - 4 times per week
- ◯ 5 or more times per week

16. How often do you eat food that is fried at home, like fried chicken?

- ◯ Never/less than once per week
- ◯ 1 - 3 times per week
- ◯ 4 - 6 times per week
- ◯ Daily

17. How often do you eat fried food away from home (like french fries, chicken nuggets)?

- ◯ Never/less than once per week
- ◯ 1 - 3 times per week
- ◯ 4 - 6 times per week
- ◯ Daily

DIETARY INTAKE

How often do you eat the following foods:

Example If you drink one can of diet soda 2 - 3 times per week, then your answer should look like this:

E1. Diet soda (1 can or glass)

- ◯ Never
- ◯ 1 - 3 cans per month
- ◯ 1 can per week
- ● 2 - 6 cans per week
- ◯ 1 can per day
- ◯ 2 or more cans per day

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BEVERAGES

FILL OUT ONE BUBBLE FOR EACH FOOD ITEM

18. Diet soda (1 can or glass)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 cans per month
- ◯ 1 can per week
- ◯ 2 - 6 cans per week
- ◯ 1 can per day
- ◯ 2 or more cans per day

19. Soda - not diet (1 can or glass)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 cans per month
- ◯ 1 can per week
- ◯ 2 - 6 cans per week
- ◯ 1 can per day
- ◯ 2 or more cans per day

20. Hawaiian Punch, lemonade, Koolaid or other non-carbonated fruit drink (1 glass)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 glasses per month
- ◯ 1 glass per week
- ◯ 2 - 4 glasses per week
- ◯ 5 - 6 glasses per week
- ◯ 1 glass per day
- ◯ 2 or more glasses per day

21. Iced Tea - sweetened (1 glass, can or bottle)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 glasses per month
- ◯ 1 - 4 glasses per week
- ◯ 5 - 6 glasses per week
- ◯ 1 or more glasses per day

22. Tea (1 cup)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 cups per month
- ◯ 1 - 2 cups per week
- ◯ 3 - 6 cups per week
- ◯ 1 or more cups per day

23. Coffee - not decaf. (1 cup)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 cups per month
- ◯ 1 - 2 cups per week
- ◯ 3 - 6 cups per week
- ◯ 1 or more cups per day

24. Beer (1 glass, bottle or can)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 cans per month
- ◯ 1 can per week
- ◯ 2 or more cans per week

N/A

25. Wine or wine coolers (1 glass)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 glasses per month
- ◯ 1 glass per week
- ◯ 2 or more glasses per week

N/A

26. Liquor, like vodka or rum (1 drink or shot)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 drinks per month
- ◯ 1 drink per week
- ◯ 2 or more drinks per week

N/A

Example **If you eat:**

3 pats of margarine on toast
1 - 2 pats of margarine on sandwich
1 pat of margarine on vegetables

5 - 6 pats total all day

then answer this way →

E2. Margarine (1 pat) - not butter
- ◯ Never
- ◯ 1 - 3 pats per month
- ◯ 1 pat per week
- ◯ 2 - 6 pats per week
- ◯ 1 pat per day
- ◯ 2 - 4 pats per day
- ● 5 or more pats per day

DAIRY PRODUCTS

27. What TYPE of milk do you usually drink?
- ◯ Whole milk
- ◯ 2% milk
- ◯ 1% milk
- ◯ Skim/nonfat milk
- ◯ Don't know
- ◯ Don't drink milk

28. Milk (glass or with cereal)
- ◯ Never/less than 1 per month
- ◯ 1 glass per week or less
- ◯ 2 - 6 glasses per week
- ◯ 1 glass per day
- ◯ 2 - 3 glasses per day
- ◯ 4+ glasses per day

29. Chocolate milk (glass)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 glasses per month
- ◯ 1 glass per week
- ◯ 2 - 6 glasses per week
- ◯ 1 - 2 glasses per day
- ◯ 3 or more glasses per day

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30. Instant Breakfast Drink (1 packet)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

31. Whipped cream
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

32. Yogurt (1 cup) - Not frozen
- ◯ Never/less than 1 per month
- ◯ 1 - 3 cups per month
- ◯ 1 cup per week
- ◯ 2 - 6 cups per week
- ◯ 1 cup per day
- ◯ 2 or more cups per day

33. Cottage or ricotta cheese
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 or more times per week

34. Cheese (1 slice)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 slices per month
- ◯ 1 slice per week
- ◯ 2 - 6 slices per week
- ◯ 1 slice per day
- ◯ 2 or more slices per day

35. Cream cheese
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 or more times per week

36. What TYPE of yogurt, cottage cheese & dairy products (besides milk) do you use mostly?
- ◯ Nonfat
- ◯ Lowfat
- ◯ Regular
- ◯ Don't know

37. Butter (1 pat) - NOT margarine
- ◯ Never/less than 1 per month
- ◯ 1 - 3 pats per month
- ◯ 1 pat per week
- ◯ 2 - 6 pats per week
- ◯ 1 pat per day
- ◯ 2 - 4 pats per day
- ◯ 5 or more pats per day

38. Margarine (1 pat) - NOT butter
- ◯ Never/less than 1 per month
- ◯ 1 - 3 pats per month
- ◯ 1 pat per week
- ◯ 2 - 6 pats per week
- ◯ 1 pat per day
- ◯ 2 - 4 pats per day
- ◯ 5 or more pats per day

39. What FORM and BRAND of margarine does your family usually use?
- ◯ None
- ◯ Stick
- ◯ Tub
- ◯ Squeeze (liquid)

WHAT SPECIFIC BRAND AND TYPE (LIKE "PARKAY CORN OIL SPREAD")?

Leave blank if you don't know.

40. What TYPE of oil does your family use at home?
- ◯ Canola oil
- ◯ Corn oil
- ◯ Safflower oil
- ◯ Olive oil
- ◯ Vegetable oil
- ◯ Don't know

MAIN DISHES

41. Cheeseburger (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 - 4 per week
- ◯ 5 or more per week

42. Hamburger (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 - 4 per week
- ◯ 5 or more per week

43. Pizza (2 slices)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

44. Tacos/burritos (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 - 4 per week
- ◯ 5 or more per week

45. Which taco filling do you usually have:
- ◯ Beef & beans
- ◯ Beef
- ◯ Chicken
- ◯ Beans

46. Chicken nuggets (6)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

47. Hot dogs (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 - 4 per week
- ◯ 5 or more per week

48. Peanut butter sandwich (1) (plain or with jelly, fluff, etc.)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 - 4 per week
- ◯ 5 or more per week

49. Chicken or turkey sandwich (1) 146
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 or more per week

50. Roast beef or ham sandwich (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 or more per week

51. Salami, bologna, or other deli meat sandwich (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 or more per week

52. Tuna sandwich (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 per month
- ◯ One per week
- ◯ 2 or more per week

53. Chicken or turkey as main dish (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

54. Fish sticks, fish cakes or fish sandwich (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 or more times per week

55. Fresh fish as main dish (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

56. Beef (steak, roast) or lamb as main dish (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

57. Pork or ham as main dish (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

58. Meatballs or meatloaf (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

59. Lasagna/baked ziti (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 or more times per week

60. Macaroni and cheese (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 or more times per week

61. Spaghetti with tomato sauce (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

62. Eggs (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 eggs per month
- ◯ One egg per week
- ◯ 2 - 4 eggs per week
- ◯ 5 or more eggs per week

63. Liver: beef, calf, chicken or pork (1 serving)
- ◯ Never/less than 1 per month
- ◯ Less than once per month
- ◯ Once per month
- ◯ 2 - 3 times per month
- ◯ Once per week or more

64. Shrimp, lobster, scallops (1 serving)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 or more times per week

65. French toast (2 slices)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

66. Grilled cheese (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

67. Eggrolls (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

MISCELLANEOUS FOODS

68. Brown gravy

- ○ Never/less than 1 per month
- ○ Once per week or less
- ○ 2 - 6 times per week
- ○ Once per day
- ○ 2 or more times per day

69. Ketchup

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

70. Clear soup (with rice, noodles, vegetables) 1 bowl

- ○ Never/less than 1 per month
- ○ 1 - 3 bowls per month
- ○ 1 bowl per week
- ○ 2 or more bowls per week

71. Cream (milk) soups or chowder (1 bowl)

- ○ Never/less than 1 per month
- ○ 1 - 3 bowls per month
- ○ 1 bowl per week
- ○ 2 - 6 bowls per week
- ○ 1 or more bowls per day

72. Mayonnaise

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ Once per day

73. Low calorie/fat salad dressing

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ Once or more per day

74. Salad dressing (not low calorie)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ Once or more per day

75. Salsa

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 6 times per week
- ○ Once or more per day

76. How much fat on your beef, pork, or lamb do you eat?

- ○ Eat all
- ○ Eat some
- ○ Eat none
- ○ Don't eat meat

77. When you have chicken or turkey, do you eat the skin?

- ○ Yes
- ○ No
- ○ Sometimes

(65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77)

BREADS & CEREALS

78. Cold breakfast cereal (1 bowl)
- ○ Never/less than 1 per month
- ○ 1 - 3 bowls per month
- ○ 1 bowl per week
- ○ 2 - 4 bowls per week
- ○ 5 - 7 bowls per week
- ○ 2 or more bowls per day

79. Hot breakfast cereal, like oatmeal, grits (1 bowl)
- ○ Never/less than 1 per month
- ○ 1 - 3 bowls per month
- ○ 1 bowl per week
- ○ 2 - 4 bowls per week
- ○ 5 - 7 bowls per week
- ○ 2 or more bowls per day

80. White bread, pita bread, or toast (1 slice)
- ○ Never/less than 1 per month
- ○ 1 slice per week or less
- ○ 2 - 4 slices per week
- ○ 5 - 7 slices per week
- ○ 2 - 3 slices per day
- ○ 4+ slices per day

81. Dark bread (1 slice)
- ○ Never/less than 1 per month
- ○ 1 slice per week or less
- ○ 2 - 4 slices per week
- ○ 5 - 7 slices per week
- ○ 2 - 3 slices per day
- ○ 4+ slices per day

82. English muffins or bagels (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

83. Muffin (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 muffins per month
- ○ 1 muffin per week
- ○ 2 - 4 muffins per week
- ○ 5 or more muffins per week

84. Cornbread (1 square)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more per week

85. Biscuit/roll (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

86. Rice
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

87. Noodles, pasta
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

88. Tortilla - no filling (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

89. Other grains, like kasha, couscous, bulgur
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

90. Pancakes (2) or waffles (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

91. French fries (large order)
- ○ Never/less than 1 per month
- ○ 1 - 3 orders per month
- ○ 1 order per week
- ○ 2 - 4 orders per week
- ○ 5 or more orders per week

92. Potatoes - baked, boiled, mashed
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

FRUITS & VEGETABLES

93. Raisins (small pack)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ 1 per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

94. Grapes (bunch)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

95. Bananas (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

96. Cantaloupe, melons (1/4 melon)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ 1 per week
- ○ 2 or more times per week

97. Apples (1) or applesauce
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

98. Pears (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

99. Oranges (1), grapefruit (1/2)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

100. Strawberries
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

101. Peaches, plums, apricots (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 or more per week

102. Orange juice (1 glass)
- ○ Never/less than 1 per month
- ○ 1 - 3 glasses per month
- ○ 1 glass per week
- ○ 2 - 6 glasses per week
- ○ 1 glass per day
- ○ 2 or more glasses per day

103. Apple juice and other fruit juices (1 glass)
- ○ Never/less than 1 per month
- ○ 1 - 3 glasses per month
- ○ 1 glass per week
- ○ 2 - 6 glasses per week
- ○ 1 glass per day
- ○ 2 or more glasses per day

104. Tomatoes (1)
- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

105. Tomato/spaghetti sauce
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

106. Tofu
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

107. String beans
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

93 94 95 96 97 98 99 100 101 102 103 104 105 106 107

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108. Beans/lentils/soybeans
- ◯ Never/less than 1 per month
- ◯ Once per week or less
- ◯ 2 - 6 times per week
- ◯ Once per day

109. Broccoli
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

110. Beets (not greens)
- ◯ Never/less than 1 per month
- ◯ Once per week or less
- ◯ 2 or more times per week

111. Corn
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

112. Peas or lima beans
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

113. Mixed vegetables
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

114. Spinach
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once a week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

115. Greens/kale
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

116. Green/red peppers
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once a week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

117. Yams/sweet potatoes (1)
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once a week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

118. Zucchini, summer squash, eggplant
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

119. Carrots, cooked
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

120. Carrots, raw
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

121. Celery
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 4 times per week
- ◯ 5 or more times per week

122. Lettuce/tossed salad
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 - 6 times per week
- ◯ One or more per day

123. Coleslaw
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 or more times per week

124. Potato salad
- ◯ Never/less than 1 per month
- ◯ 1 - 3 times per month
- ◯ Once per week
- ◯ 2 or more times per week

Think about your usual snacks. How often do you eat each type of snack food.

Example If you eat poptarts rarely (about 6 per year) then your answer should look like this:

E3. Poptarts (1)
- ● Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 - 6 per week
- ○ 1 or more per day

SNACK FOODS/DESSERTS

125. Fill in the number of snacks (food or drinks) eaten on school days and weekends/vacation days.

Snacks	School Days					Vacation/Weekend Days				
	NONE	1	2	3	4 OR MORE	NONE	1	2	3	4 OR MORE
Between breakfast and lunch	○	○	○	○	○	○	○	○	○	○
After lunch, before dinner	○	○	○	○	○	○	○	○	○	○
After dinner	○	○	○	○	○	○	○	○	○	○

126. Potato chips (1 small bag)
- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ One small bag per week
- ○ 2 - 6 small bags per week
- ○ 1 or more small bags per day

127. Corn chips/Doritos (small bag)
- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ One small bag per week
- ○ 2 - 6 small bags per week
- ○ 1 or more small bags per day

128. Nachos with cheese (1 serving)
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 or more times per week

129. Popcorn (1 small bag)
- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ 1 - 4 small bags per week
- ○ 5 or more small bags per week

130. Pretzels (1 small bag)
- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ 1 small bags per week
- ○ 2 or more small bags per week

131. Peanuts, nuts (1 small bag)
- ○ Never/less than 1 per month
- ○ 1 - 3 small bags per month
- ○ 1 - 4 small bags per week
- ○ 5 or more small bags per week

132. Fun fruit or fruit rollups (1 pack)
- ○ Never/less than 1 per month
- ○ 1 - 3 packs per month
- ○ 1 - 4 packs per week
- ○ 5 or more packs per week

133. Graham crackers
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ 1 - 4 times per week
- ○ 5 or more times per week

134. Crackers, like saltines or wheat thins
- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ 1 - 4 times per week
- ○ 5 or more times per week

125 Sa Sb Sc 126 127 128 129 130 131 132 133 134

135. Poptarts (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 poptarts per month
- ○ 1 - 6 poptarts per week
- ○ 1 or more poptarts per day

136. Cake (1 slice)

- ○ Never/less than 1 per month
- ○ 1 - 3 slices per month
- ○ 1 slice per week
- ○ 2 or more slices per week

137. Snack cakes, Twinkies (1 package)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ Once per week
- ○ 2 - 6 per week
- ○ 1 or more per day

138. Danish, sweetrolls, pastry (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

139. Donuts (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 donuts per month
- ○ 1 donut per week
- ○ 2 - 6 donuts per week
- ○ 1 or more donuts per day

140. Cookies (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 cookies per month
- ○ 1 cookie per week
- ○ 2 - 6 cookies per week
- ○ 1 - 3 cookies per day
- ○ 4 or more cookies per day

141. Brownies (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 4 per week
- ○ 5 or more per week

142. Pie (1 slice)

- ○ Never/less than 1 per month
- ○ 1 - 3 slices per month
- ○ 1 slice per week
- ○ 2 or more slices per week

143. Chocolate (1 bar or packet) like Hershey's or M & M's

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 - 6 per week
- ○ 1 or more per day

144. Other candy bars (Milky Way, Snickers)

- ○ Never/less than 1 per month
- ○ 1 - 3 candy bars per month
- ○ 1 candy bar per week
- ○ 2 - 4 candy bars per week
- ○ 5 or more candy bars per week

145. Other candy without chocolate (Skittles) (1 pack)

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

146. Jello

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

147. Pudding

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

148. Frozen yogurt

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

149. Ice cream

- ○ Never/less than 1 per month
- ○ 1 - 3 times per month
- ○ Once per week
- ○ 2 - 4 times per week
- ○ 5 or more times per week

150. Milkshake or frappe (1)

- ○ Never/less than 1 per month
- ○ 1 - 3 per month
- ○ 1 per week
- ○ 2 or more per week

151. Popsicles

- ○ Never/less than 1 per month
- ○ 1 - 3 popsicles per month
- ○ 1 popsicle per week
- ○ 2 - 4 popsicles per week
- ○ 5 or more popsicles per week

152. Please list any other foods that you usually eat at least once per week that are not listed (for example, coconut, hummus, falafel, chili, plantains, mangoes, etc. . .)

FOODS	HOW OFTEN?
a)	a)
b)	b)
c)	c)
d)	d)

a	b	c	d
0 0 0	0 0 0	0 0 0	0 0 0
1 1 1	1 1 1	1 1 1	1 1 1
2 2 2	2 2 2	2 2 2	2 2 2
3 3 3	3 3 3	3 3 3	3 3 3
4 4 4	4 4 4	4 4 4	4 4 4
5 5 5	5 5 5	5 5 5	5 5 5
6 6 6	6 6 6	6 6 6	6 6 6
7 7 7	7 7 7	7 7 7	7 7 7
8 8 8	8 8 8	8 8 8	8 8 8
9 9 9	9 9 9	9 9 9	9 9 9

a	b	c	d
0 0	0 0	0 0	0 0
1 1	1 1	1 1	1 1
2 2	2 2	2 2	2 2
3 3	3 3	3 3	3 3
4 4	4 4	4 4	4 4
5 5	5 5	5 5	5 5
6 6	6 6	6 6	6 6
7 7	7 7	7 7	7 7
8 8	8 8	8 8	8 8
9 9	9 9	9 9	9 9

THANK YOU FOR COMPLETING THIS SURVEY!

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1 2 3 4 5 6 7 8 9 10 11 12 93 94 95 96 97 98 99

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